The WARRIOR/ELYSA Experience: A FEDEP Use Example

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ABSTRACT: *France and the United States (U.S.) have entered into a cooperative experiment initiated under the auspices of the Data Exchange Agreement 1200 (DEA 1200) on "analysis and simulation". The experiment involves federating the French ELYSA simulation with the U.S. WARRIOR simulation. The experiment's main objective is to serve as an experimental framework to allow participants of both French and U.S. teams to educate themselves on the HLA practices.*

The first stage of the experiment focused on the HLA Federation Development and Execution Process use (FEDEP, version 1.4). Specifically, researchers concentrated on the four initial phases of the FEDEP, elaborating SOMs of WARRIOR and ELYSA applications and a FOM. The implementation of a future federation will depend upon available resources and the level of interest of the DEA sponsors. Nevertheless, the WARRIOR-ELYSA federation has proven to be a valuable exercise for both teams and has met its initial objectives.

Significant insights have been produced regarding the FEDEP, a process that has proven useful and customizable. Papers presented in previous Simulation Interoperability Workshops (mainly in the PROC forum) consider a SOM as:

- *either as an extensive and complete description of the capabilities provided by a federate,*
- *or as a more restrictive description of the capabilities that a simulation is able to provide inside a particular federation, and, therefore, the SOM should be adapted to that purpose.*

The SOM topic should be discussed in the PROC forum and the exact meaning and method of documentation of a SOM has to be emphasized (and clarified if required), in future versions of the HLA OMT standard. This paper describes the context and the exact nature of the WARRIOR-ELYSA experiment, describes federates selected for the federation, highlights the principal findings of the work, and discusses the twofold aspect of SOMs. Some conclusions and recommendations are provided.

1. Context and History of the Experiment

1.1. Context and Past Experiences

This cooperative experiment between France and the U.S. has been initiated under the auspices of the Data Exchange Agreement 1200 (DEA 1200) on "analysis and simulation".

The DEAs between France and U.S. provide flexible and useful contexts to undertake cooperative actions between both nations. In every case, each country funds its own actions. Past activities under such contexts have been very successful. Cooperative exercises have been achieved involving both nations providing mutual progress on the cultural and technical point of views. The particular context of the DEA 1200 is a good example of the way those agreements are running.

DEA 1200 cooperative work on advanced distributed simulation (ADS) was originally stimulated by the decision of the U.S. Department of Defense (DoD) to promote the use of ADS technologies in the early 90s. DEA responsible parties considered 1995 as the right time to initiate a first cooperative experiment on ADS, a time where state-of-art methodologies and techniques (more precisely networking and high level interoperability standards) became available. Both French and U.S. Technical Project Officers (TPOs) of DEA 1200 agreed that the use of ADS could facilitate the execution of common studies, avoiding the exchange of national tools and classified data, without organizing numerous international meetings, and therefore saving resources of both nations.

In May 1995, the first experiment took place between TRADOC Analysis Center (TRAC)-White Sands Missile Range (WSMR) and "Centre d'Analyse de la Defense" (CAD, the French Center for Defense Analysis). It was considered very successful for the following reasons:

Investment: The experiment required a small cost from both nations;

Technical aspect: the experiment achieved its time objective without major difficulties despite a tight schedule;

Operational aspect: the experiment involved Army officers from both nations who considered this way of working as valuable, despite the practical constraints of distance and the eight hour time difference between the two countries.

The first experiment was based on the Distributed Interactive Simulation (DIS) standard, demonstrating both advantages and limitations to DIS. The experiment also suffered from limitations in networking capability, even when the networking requirements were prudently limited.

By 1996, the U.S. DoD introduced the initial definition of its new interoperability standard: the High Level Architecture (HLA). The use of HLA within the U.S. DoD became mandatory in September 1996 and was adopted by NATO in November 1998. It was clear that the HLA was the right standard to use in any future cooperation when linking simulation applications. In 1998, both DEA 1200 TPOs considered this an opportune time to start a second phase in their cooperation on ADS, based on the HLA.

This second experiment is the basis for that paper. Compared with other HLA projects, this experimental federation has modest goals. Therefore, it has provided useful findings and raised interesting methodological issues that will benefit the M&S community.

1.2. The HLA WARRIOR/ELYSA Experiment: Objectives and Description

The aim of this experiment is to demonstrate the ability to federate two cross-continent simulations via a global communications network, using the HLA standard. The experimental federation will perform in accordance with HLA rules and guidelines.

Lessons learned from this experiment will be documented and made available to federation developers to support future HLA federations. The lessons learned will also facilitate the ability of both countries to interoperate and enter into future HLA federations.

The federation is mainly designed to achieve technical aspects rather than operational ones. In the first phase of the experiment (the only phase completed thus far), researchers concentrated on the *methodological aspect*. This aspect is mainly related to the HLA rules and the OMT formalism. It is equally treated within the first four steps of the six-step HLA Federation and Development Process (FEDEP) document.

Concerning operational aspects, the federation will provide the capability to analyze a coalition force mix for investigating force protection capabilities.

The federation will also examine appropriate mixes of integrated air defense assets necessary to defend coalition forces against multiple threat levels.

Finally, the federation will analyze the effects of varying terrain and environmental conditions on the effectiveness of integrated air defense packages.

For the French, CAD is the leading organization. CAD is a technical center of the procurement agency of the French Ministry of Defense, the General Delegation for Armament (DGA). Other French participants include the CASI (the simulation center of the French Air force) and the CROSAT (the simulation center of the French Army). TRAC Monterey is the leading U.S. organization.

The federation is developed on the following three federates. The French ELYSA application of simulation developed by CAD. ELYSA was developed using the simulation support environment "ESCADRE" which supports the HLA. The U.S. ground combat simulation WARRIOR developed by TRAC Monterey is the primary U.S. federate. WARRIOR is based on the legacy simulation Janus. An HLA data collection and analysis tool developed by TRAC Monterey, called "Analysis Federate" is the third federate. Both participants used the Janus simulation as a common reference, for scenario definition and conceptual modeling phases.

All federates are constructive and can run in real time as well as faster than real time. The federation will utilize RTI time management functions to ensure synchronization of federates during run time. Message delivery will be "reliable".

Due to the experimental context of the federation, no constraints on repeatability, portability, security and validity have been enforced.

The first phase of the experiment was carried out using the Internet as a medium for discussion and exchanging documents. Only two face to face meetings were held due to traveling constraints and costs:

2 days in Paris (June 1999), where federates were presented and the scenario selected, and

3 days in Monterey (November 1999), when FEDEP phases 2, 3, and part of 4 were completed, culminating with the production of a FOM.

The Internet collaboration done prior to these two brief meetings ensured the meetings yielded tremendous benefits for the federation developers. Meetings such as these should be considered indispensable to starting any federation.

Very few individuals involved in the experiment had practical experience in the HLA, though most had carefully studied HLA documents and attended HLA tutorials prior to starting the experiment. The lack of practical HLA experience has not been a considerable disadvantage and the experiment has proven manageable.

2. The WARRIOR Project

2.1 Background

In June 1998, the TRADOC Deputy Chief of Staff for Training agreed to fund research that re-hosted Janus on a personal computer (PC) running Windows NT. TRAC-Monterey began an aggressive 18-month development plan that culminated with a proof of principle demonstration (POP-D) in January 2000. Subsequently, the National Simulation Center (NSC) joined the project as a full partner and committed to integrate the next generation of Spectrum with WARRIOR following the POP-D.

2.2 Organization

The project has two phases. In Phase I, TRAC-Monterey coordinates and leads the re-hosting effort incorporating baseline requirements. In Phase II, NSC assumes lead for integrating Operations Other Than War (OOTW) into the re-hosted model, as well as linking WARRIOR to the Army's command, control, communications, computers, and intelligence (C4I) systems.

2.3 Research Description

The WARRIOR project applies advanced computer simulation technologies such as making the new simulation HLA compliant, integrating an innovative system architecture, developing an object-oriented design, using state-of-the-art graphical user interfaces (GUIs), and designing and implementing a modular terrain component. The re-hosted simulation will provide valuable lessons to the modeling and simulation community for the next generation of Army military simulations such as OneSAF, Combat XXI, and WARSIM.

2.4 Goal

The project goal is to demonstrate the use of advanced technologies to support development of future generation military simulations.

Modern Technologies. The WARRIOR hardware platform, software applications, and GUI conform to current commercial standards. WARRIOR is primarily

designed for a PC running Windows NT. WARRIOR is being developed using C++, a high-level third generation programming language that supports the object-oriented design. Additionally, WARRIOR uses Vision XXI, a state-of-the-art commercial GUI that offers many advanced development options. Finally, WARRIOR leverages Janus software innovations developed during the past decade while applying new, cutting-edge software architecture for the next decade.

System Modularity. The WARRIOR architecture follows a modular approach in the design of high-level system components. For example, the WARRIOR GUI runs as a separate process distinct from the WARRIOR simulation application. WARRIOR's object-oriented design also promotes modularity in the sense that application domain models are objects that encapsulate attributes (local data) and methods (code or scripts). The object-oriented design enables future enhancements without major code rewrites and supports model reuse.

Advanced Distributed Simulation. The WARRIOR operational requirements demand that it operate in a distributed, interactive mode with other models. The system architecture allows different instances of the WARRIOR model to function on distributed, networked computers integrated through a single internal distribution mechanism. WARRIOR also interoperates with other distributed models using either Institute of Electrical and Electronic Engineers (IEEE) approved DIS protocols or the DoD standard HLA specifications and rules. [5]

3. The ELYSA Simulation Application

3.1 Main Characteristics of ELYSA

ELYSA is a constructive, as fast as possible, discrete-event stepped simulation. It was developed in the 1990s to support studies on future battlefield air defense. The more complete version of ELYSA was designed to compare different concepts of short-range and very short-range air defense weapon systems or to assess effectiveness of different combinations of air defense layouts. Air targets that can be modeled are rotary and fixed wing aircraft, cruise missiles, drones, and some types of air-to-ground missiles. Because WARRIOR is oriented towards land combat, both simulations are complimentary and will portray all aspects of ground and air combat as outlined in the basic scenario.

As a legacy simulation, ELYSA was never designed to be HLA compliant, but plans have been made for ELYSA to undergo HLA compliance testing in Spring 2000.

ELYSA was developed using the CAD simulation support environment (SSE) ESCADRE that has been presented twice at previous Simulation Interoperability Workshops (SIWs) [1] [2].

3.2. ESCADRE and HLA

In French, ESCADRE means "Environnement de Simulation en Conception orientée objet et Ada pour le Développement et la Réutilisabilité des Etudes", that can be translated into "Simulation environment based on object oriented design and Ada language for development and reuse of studies". The ESCADRE SSE provides simulation developers and users with a methodology and a toolbox for developing and running constructive simulations for systems design and feasibility studies. The ESCADRE toolbox offers users common services such as object and interaction management, logical time management (events scheduling and continuous state-variables integration), and a graphical user interface based on OSF/Motif, etc. The current version of the ESCADRE tool set is written in Ada 95. ESCADRE applications developers use the framework to build new simulations using building blocks. To fully benefit from that, they have to construct and manage object and interactions repositories, allowing them to customize new and legacy applications to specific requirements. Using this capability, a simplified version of ELYSA has been selected for the WARRIOR/ELYSA experiment, that means a minimal version (composed with a limited number of object and interaction classes) to run the selected scenario.

ESCADRE has been regularly upgraded and used since 1987 for building simulation applications, in operational analysis and weapon systems design fields, by French government organizations and some defense companies. ESCADRE is also used in the context of cooperative efforts with Germany and the UK. Some tens of simulations are currently based on ESCADRE and as the user community is continuously enlarging, it seemed obvious in 1997 that a new ESCADRE version supporting the HLA should be profitable in the near future. The HLA version of ESCADRE became available November 1999.

Not only does the ESCADRE API provide a user-friendly interface with RTI services, but the ESCADRE methodology has also been modified to comply with the current HLA practices.

ELYSA has been selected as a typical ESCADRE simulation application to pass HLA compliance testing, with the objective of demonstrating the ability of ESCADRE to support and facilitate the elaboration of HLA constructive federates. Because of the WARRIOR/ELYSA experiment, ELYSA's SOM has been elaborated and will serve as a basis for HLA compliance testing.

4. The WARRIOR/ELYSA Experiment of the FEDEP

The FEDEP [9] was continuously used as a guideline during the WARRIOR/ELYSA experiment. Between the two face to face meetings of the experiment, it happened that the number of phases of the FEDEP increased from 5 to 6. This development was not an issue and was considered by the WARRIOR/ELYSA team as a natural evolution of the FEDEP.

Some may feel there is little improvement possible to the FEDEP, but this view is too restrictive. It should be realized that the structure and the content of the FEDEP document will have to be transformed in some way, to take advantage of the numerous future federates and federations developed in the HLA.

Due to the particular conditions of the WARRIOR/ELYSA experiment researchers realized that not all findings would be the norm. We selected the federates a priori and customized the scenario to fit those federates. Our method of selecting federates up front is contrary to FEDEP guidance but necessary for our experiment. Therefore, the only facts reported in this paper are those which were judged useful for other federations.

Findings listed below may lead to improvements that could be included in a future version of the FEDEP document for the benefit of the entire M&S community.

4.1. General remarks on the FEDEP

We found the FEDEP document to be an invaluable source of information for conducting this experiment. However, the FEDEP document and the FEDEP checklists were not the only documents researchers used. We referred to other published papers and presentations related to the FEDEP [9] [12]. A majority of available documents dealt with the final steps of the FEDEP process, probably because early HLA efforts focused on the feasibility of HLA which is centered on the final stages of the FEDEP process (implementing and executing the federation). The WARRIOR/ELYSA experiment thus far focused on the initial three FEDEP steps. Unfortunately there is relatively little documentation available discussing the first few FEDEP steps as compared to robust documentation related to development and execution of federations.

Federation developers recognized that participation of officers (the final end users of the federation) during FEDEP steps 1 to 4 was a good opportunity for the development team. This fact has already been reported in a previous SIW presentation [12], and also emphasized the importance of user participation during the first two steps of the FEDEP. In the case of WARRIOR/ELYSA, all participants were in fact users or future implementers.

4.2. Steps 1 and 2 of the FEDEP

Step 1 is concerned with "the definition and the objectives of the federation". This step is very clear and adequate and few comments were made on this part of the FEDEP.

Researchers identified only one improvement. For operational considerations, it is extremely important to identify very early in federation development, (for example, in the "needs statement"), what coordinate system will be used say (UTM or Cartesian) and a preliminary definition of the aggregation levels that should be supported by the federation. These initial specifications are not typical of distributed simulations, but reflect good practices in the design of applications.

If not defined in the documentation produced during step 1, these important features should be clearly reported in the second step, when developing the federation scenario or performing conceptual modeling.

These requirements could be easily documented in either paragraph 3.1.2 ("Develop objectives") or 3.2.1. ("Develop scenario") of the FEDEP document and not just listed within the FEDEP checklists. This criteria could have an impact in the selection of candidate federates and the amount of modifications the proposed candidate will need in order to join the federation.

The conceptual analysis was the most difficult part of the WARRIOR/ELYSA experiment. Few reports are available on this subject. Some useful object oriented (OO) methodologies and tools exist. Team members had knowledge of such approaches, but no one was

able to positively identify the better methodology and toolkit to use. Nevertheless, the team members in charge of producing a "conceptual model" succeeded in producing one that appears clear and useful, without referring to a particular method.

It is therefore difficult to recommend a particular object oriented methodology and toolkit to perform this step. The SIW PROC forum is a good venue to share experiences and describe methods that can be used to achieve the development of conceptual models.

4.3. Steps 3 and 4 of the FEDEP

As previously described, few comments about FEDEP step 3 could be derived from this experiment, since federates were pre-selected for their availability and HLA capability.

When applicable the HLA Object Modeling Library (OML) and other Defense Modeling and Simulation Office (DMSO) tools were used when designing the WARRIOR/ELYSA FOM.

The WARRIOR/ELYSA team made the deliberate decision to develop a FOM very early in the FEDEP process even though the FEDEP recommended starting this activity after step 3. This draft or "ideal FOM" was very useful in the step 3.2 activity ("allocate functionality").

A general remark about FEDEP step 3 is if the "Federation Development Plan" is excepted by the participants then no other document is defined in the FEDEP as a step 3 identified output.

Other users felt the need for such a document. Authors of "Design and Execution of a Federation for Experimentation" [12] described a "Federation Implementation Document" (the Trailblazer FID) which was initiated during step 1 of the Trailblazer federation development and used throughout the remaining FEDEP steps. A document such as the FID allows recording of a large part of the conceptual model, allocation of functionality between federates, and federation agreements, as decided by federation participants in step 4.

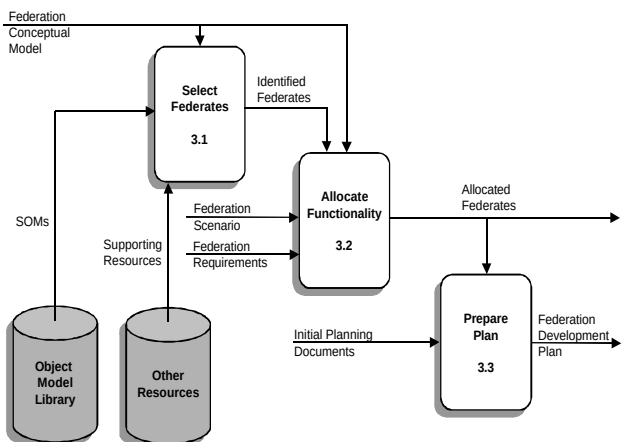

Figure 1. "Design Federation" (Step 3 of the FEDEP)

FEDEP step 4 was limited to building the FOM only. The basis for the FOM was the WARRIOR SOM. The WARRIOR SOM had the most detailed SOM of all participating federates. It was then only necessary to modify the WARRIOR SOM and integrate the ELYSA capabilities within it. This practice is one of the five approaches recommended by the FEDEP document and appeared to work successfully.

One note about the federation agreements: no output document is identified as such in the FEDEP document. The FID previously mentioned could be used for that purpose. Another type of table has been used in previous federations and called a "federate-class mapping table" [11]. This table could be cited in the FEDEP document as a required output from step 3 and used as an input in step 4.

5. SOM/FOM Concepts and Considerations

The WARRIOR/ELYSA experiment brought up interesting questions concerning the aspects of SOMs. Both U.S. and French partners have different views of the SOMs concept. Both approaches to SOM development and use appear viable and complementary, but raise some questions about the exact meaning and use of a SOM as part of the HLA standard.

5.1. SOM Basic Definition

The basic definition of a SOM as defined in the DoD HLA standard document [14] is "*An HLA SOM is a specification of the intrinsic capabilities that an individual simulation could provide to HLA federations. The standard format in which SOMs are expressed facilitates determination of the suitability of simulation systems for participation in a federation*."

The important word is "intrinsic", which suggests that a SOM should record everything modeled within the federate including those functions that could be used in other federations the federate may wish to join. In

this case, the SOM developer records in the SOM tables every object, attribute, interaction or parameter, including those internal to the model.

The draft SOM developed by TRAC Monterey for WARRIOR [4] [7] followed this "intrinsic" method of SOM development and was an extensive and complete representation of the federate. The draft WARRIOR SOM proved very useful as a permanent record of all public and private information contained in the WARRIOR source code. Because of this, WARRIOR SOM developers referred to the draft SOM as a Comprehensive Object Model (COM) rather than a SOM. The final WARRIOR SOM was later gleaned from the COM. For French researchers, who were not experts in Janus from which WARRIOR is derived, this "comprehensive SOM" was sometimes difficult to use, even if it was well commented.

5.2. Other Views of a SOM

For the experiment, the French team produced a partial view of the original ELYSA application and only included within the ELYSA SOM those objects and interactions required for representing the federation scenario, anticipating the work share between WARRIOR and ELYSA.

The French perspective was that a SOM is only a view of the "public" or publishable portion of the federate, not of the "private" part. For example, an internal variable used in the code to represent a specific state of an object should not be shown as a publishable parameter or attribute, since it is unusable by other federates. Furthermore, the expression "the simpler, the better" leads to hiding details of underlying algorithms used to model certain functions within the simulation. Finally, ELYSA is supported by a simulation environment that recommends and facilitates the application of encapsulation and information hiding principles, generally considered as good practices in computer engineering. However, these two rules do not facilitate access to some variables.

An excellent discussion underlining the interpretation of a SOM as a partial view of the public part of a simulation can be found in the paper titled "The role of Collaborative DEVS Modeler in Federation Development " [17]. In that paper, OMT features are paralleled with the HLA rules 7 to 9 and it is stated: "*The specifics of what might comprise a federate's behavior are unspecified by HLA rules and OMT. As mentioned earlier, such knowledge is considered supplementary as far as building HLA-compliant simulations. Consequently, the interactions among the components of a modular, hierarchical model (federate) neither can be captured by OMT nor do they have to comply with any of HLA rules. The exclusion of each federate's internals is due to the fact that a federate can be anything represented by HLA object models*". In that paper, everything not included (and somehow lacking) in a SOM is exposed and justified, recalling the initial re-use and interoperability objectives of the HLA.

Many federation developers have previously adopted a public view of a SOM. In the paper titled "Starting Points for Representing Humans within the High Level Architecture (HLA): The Human Starter SOM and Human FOM Starter Set " [13], the authors used an interesting image to explain what a SOM should be.

" To make a Mechanical Engineering analogy, assume that a SOM is like a part of a mechanism, say a gear. A FOM is then like the whole mechanism. If someone is building a mechanism and needs a gear, then the person will design a gear to do just what is needed. If, instead, the person plans to sell gears to mechanism designers, then he might design a whole family of gears that work together. But a person would rarely design a single gear without knowing how it would work in a given mechanism, or how it would fit in with a family of similar gears.

Similarly, one might design a SOM as an element of a given FOM. Or one might design a set of SOMs as building blocks for FOMs. The working group found it very difficult to design a single SOM …"

Other papers have emphasized the perspective of a SOM dependant of a particular federation [15] and [16]. The French team viewpoint parallels the federation dependent view and they produced a SOM clearly adapted to the WARRIOR/ELYSA scenario.

5.3 SOM Aspect Discussions

During the experiment the SOM development concepts of both teams appeared equally useful and valid. Both development concepts also demonstrated drawbacks, which prevented an immediate conclusion. Instead, we suggest continuing the discussion on that topic in a desired venue, such as the SISO PROC forum.

An immediate conclusion is that the definition of a SOM, as recorded in the DoD HLA standard document, is not adapted to reflect the current practices and therefore should be modified. A SOM is neither an "intrinsic" view of the federate, nor a partial guarantee of HLA compliance as some may

believe. A suggestion is that the definition be defined as a "public view" of a federate, meaning neither an external view of the federate, nor an extensive view. Building a SOM in this manner will facilitate reuse. The problem starts when you have to advise developers how to build such a SOM. Past papers have underlined this difficulty in developing a SOM in this way [5] and [16].

Standardizing the SOM process will be challenging, but the recommendations here will facilitate future SOM research.

5.4. FOM Elaboration Findings

FOM concepts and features raise different issues than SOM development. Only one significant remark can be made about FOM content. The FOM does not provide a place to record the common coordinate system used within the federation. The choice of a coordinate system has to be made early before discussing the conceptual model and it clearly has implications when developing the FOM. Coordinate transformation is the responsibility of individual federates, but it is important to provide each federate with a level of information consistent with their internal level of modeling.

The differences between coordinate systems used by WARRIOR and ELYSA, in conjunction with different concepts and levels of modeling, have provoked interesting negotiations between participants. The exact nature and meaning of attributes to be exchanged between federates to satisfy federation requirements provided useful insights.

One simple example: WARRIOR will publish a variable named "speed". "Speed" corresponds to the absolute value of the velocity vector of aircraft. In ELYSA, the attribute "velocity" is a tri-dimensional vector, expressed in a Cartesian coordinate system. That was an interesting (but easily resolved) issue. However, the compromise has implications on the way ELYSA will reflect aircraft modeled by WARRIOR. This kind of information clearly depends on underlying hypotheses which have to be recorded somewhere.

6. Summary and recommendations

The WARRIOR/ELYSA experiment has produced valuable lessons learned. All participants realized that the first four steps of the FEDEP are challenging. A possible reason for this is that less documentation is available for steps one to three of the FEDEP than steps four to six. This lack of detailed documented use cases forces federation developers to break new ground each time a federation is developed.

The most difficult task for the WARRIOR/ELYSA team was the "conceptual analysis" due to the difficulty in applying a dedicated methodology and associated tools as recommended in the FEDEP. Despite this fact, participants judged the HLA FEDEP very useful and practical.

The experiment highlights improvements to the process that could be made in the near future. Other changes will become apparent when a significant operational federations are developed. Two clear suggestions were derived from the WARRIOR/ELYSA experiment:

- The first proposal would be the introduction within the FEDEP of specific documentation at the end of the phase 3.2 (allocate federates) recording the choices made and the respective responsibilities of selected federates.
- The second proposal is that a first version of the FOM be started during step 3. Some authors have named it an "ideal FOM". Since the FOM is one of the central elements of interoperability provided by HLA, developers are very familiar with this concept and there is little doubt that the FOM format will evolve to register a larger amount of required information.

The common federation system of coordinates shared by a set of federates is one very significant example of the type of information that could be added in the FOM/SOM tables.

The final topic raised during the WARRIOR/ELYSA experiment is the exact meaning of a SOM. Should it be an extensive description of the capabilities of a federate in terms of objects and interactions? How can it be intrinsic, thus avoiding reviewing it every time we integrate a different federation? This topic should be discussed in detail.

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- CROSAT: LCL François Fatz & LCL Sully Barbe;
- CAD: José Ruiz, Emmanuelle Oudotte, LCL Marc Lagneau.

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